Sakolski, Aaron Morton
Apportionment of
railroad expenses

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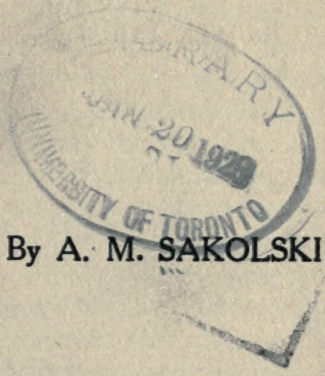

By A. M. SAKOLSKI

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Apportionment of Railroad Expenses and Property Values on Basis of Use

By A. M. Sakolski.

The United States supreme court decisions in the *Northern Pacific Railroad Company vs. North Dakota,* and in the *Norfolk and Western Railway vs. West Virginia* cases of March 15, 1915, upheld the principle that the reasonableness of passenger or freight rates shall be determined with reference to a fair return on the value of the property used in each class of service. This is an application of Justice Hughes' ruling in the Minnesota rate cases that when rates are in controversy "there should be assigned to each business that portion of the total value of the property which will correspond to the extent of its employment in the business." It is also in line with the "cost-of-service" rate-making policy of the interstate commerce commission expressed in the five per cent. rate case (1) and exemplified by the accounting order effective July 1, 1915, whereby the railroads are required to classify certain expense items as passenger, freight and mixed and to apportion as between passenger and freight most of the items common to both services. The order, however, prescribes only to a limited extent the rules for apportionment. Thus, yard expenses not directly assignable are to be allotted on the basis of the number of switching locomotives in each service. No rules are laid down for the subdivision of maintenance of way costs, and these are to be recorded in the accounts as undivided.

The question of the separation of operating expenses as between passenger and freight service is not new. As early as 1850, in accordance with the recommendation of the state engineer and surveyor, the New York legislature enacted a general railroad law which provided that the railroad companies classify "all the items under the heads of expense of maintaining the road or real estate of the corporations, expense of machinery or personal property—expense of use of road and machinery," etc.,

(1) "In our opinion each branch of the service should contribute its proper share of the cost of operation and of return upon the property devoted to the use of the public."—31 I.C.C. p. 392.

under two heads, the one showing cost of freight transportation, the other, the cost of passenger transportation (1). No basis of separation was prescribed. Accordingly, during the forty years when the provision was nominally in effect, the railroad companies reported the separation of expenses as they desired (2) —a number submitting statements showing no separation whatever.

Prior to 1894, a separation of freight and passenger expenses was required in the annual statements of the carriers to the interstate commerce commission. This was abandoned after earnest solicitation by railroad accountants, state railway commissioners and statisticians (3). Several of the railroad companies, however, notably the Pennsylvania Railroad, for administrative purposes continued to apportion certain operating costs on an arbitrary basis, but were careful not to designate the results as correct cost accounting data (4). Accordingly there were few, if any, serious attempts to apply the results in rate controversies.

Of late years, owing to the growth of the "cost-of-service" principle as an element in reasonable rate determination several attempts have been made to go further than any of the railroad companies or the regulating commissions in the matter of separation of operating expenses and property values as between the passenger and freight services.

In 1914, under the auspices of the state of Oklahoma, a comprehensive scheme was drawn up for the apportionment of expenses between passenger and freight services. This experiment was the result of the work of a committee of which James

(1) See laws of New York, 1850, chap. 140.

(2) In the year 1882 the New York Central and Hudson River Railroad's apportionment was on the basis of one-third passenger and two-thirds freight; the Erie's ratios of apportionment were 24% passenger, and 76% freight. The Delaware, Lackawanna and Western had a still different basis of apportionment.

(3) Thus, the committee on uniformity of accounts of the National Association of Railway Commissioners reported in 1892:

> "The test of actual practice fails to satisfy us that these rules (i. e., concerning separation of passenger and freight expenses) are of any utility either to the companies, the states, or the nation. Indeed, if not substantially correct they could not be expected to be useful and may prove positively vicious. We know that results have been reached by the application of these rules for division which are grossly erroneous not to say preposterous."—*Proceedings of the Fourth Annual Convention of the National Association of Railway Commissioners*, p. 23.

(4) See testimony of President Rea of the Pennsylvania Railroad in the five per cent. case, p. 4155, et seq. Also *Proceedings of the 26th Convention of the American Economic Association*, p. 93.

Peabody, statistician of the Atchison, Topeka & Santa Fé, was chairman. Nothing is yet known of its application to any railroad system, and in view of the interstate commerce commission's accounting order directing a new classification of expenses as passenger, freight and mixed, it is probable that the Oklahoma plan will not be put into operation. Its influence, however, is noticeable in the more recently proposed schemes and has been, no doubt, a factor of encouragement to the interstate commerce commission to develop a workable plan to enforce a strict cost accounting system upon the railroads.

Apparently with a view to furthering its cost accounting plans the interstate commerce commission, in its recent investigation—western passenger fares—sent out an interrogatory regarding the methods ordinarily used in the separation of passenger and freight expenses. Information was requested as to the amounts directly allocated to passenger and freight services, the amounts regarded as common, and the method believed by each carrier to be the most equitable for the assignment of common expenses. From the replies recorded, the commission, without advocating or upholding any method, enumerated the following different bases of allocating expenses not directly assignable to either service.

Basis I—An arbitrary formula adopted or customarily used by the carrier.

Basis II—Revenue engine ton-miles (sometimes termed locomotive weight miles).

Basis III—Revenue train miles.

Basis IV—Locomotive repairs and transportation costs.

Basis V—Engine ton miles, including switching and yard engine ton-miles.

Basis VI—Combination of all of the foregoing.

It is evident that this classification is neither scientific nor instructive. In fact, there are only two distinct bases in the whole classification—(1) engine weight and (2) train mileage. Bases II and V designate use as the product of engine weight and engine miles. Basis III, on the other hand, eliminates the element of weight and restricts the measure to train-miles. For the purpose of merely gauging operating efficiency from year to year and for studying the trend of expenses by class of service, the train-mile basis of apportionment, from a practical administrative

standpoint, is not objectionable (1). But for thorough, scientific analysis and as a correct and accurate accounting device it is wholly inadequate. As a yard-stick it measures only one of many factors which influence relative costs of operation assignable to different classes of service. Its chief defect as a statistical unit lies in its lack of homogeneity by reason of which no consideration is given to two most pronounced elements of damage to road-bed and track, weight and speed (2).

Obviously, the ignoring of weight and speed as elements affecting maintenance costs is a serious omission. However, it is claimed that the high speed of passenger trains is an equalizing factor offsetting the excess of weight of freight trains, and for this reason neither weight nor speed need be considered in the application of the train-mile unit for measuring cost of maintenance. The advocates of the locomotive weight basis, however, refer to the fact that the size of the locomotive indicates roughly the weight and character of the whole train, and inasmuch as the greater speed of passenger trains necessitates more hauling power than would be required to move a freight train of equal weight, the locomotive-ton-mile unit makes allowance for the speed factor in computations of relative damage to road-bed and track. It is for this reason that the locomotive-ton-mile (3) is undoubtedly superior to the train-mile as a measure of relative use. This is recognized by the interstate commerce commission in its analysis, but at the same time attention is called to the following fact:

> There is . . . a large proportion of the expenses incident to the maintenance of way and structures that is influenced only to a small extent and certain expenses are not influenced at all by the weight and speed of the trains that pass over the track. The action of the elements and deterioration of materials will go on whether trains pass over the tracks or not. It is uncertain how much of any particular item of expense is due to action of the elements and how much to wear. (4)

(1) It is interesting to note that the train-mileage basis of apportionment has been long used by the Pennsylvania Railroad and was also adopted and used by the interstate commerce commission during the period 1888-1893 inclusive, when reports of operating expenses separated as between passenger and freight were required from the carriers. It was also partly adopted in 1907 by the Wisconsin railroad commission, whose method of apportioning freight and passenger expenses was followed by the postmaster-general in an inquiry concerning the cost of carrying mails to the railroads.

(2) For a discussion of the defects of the "train-mile" as a statistical unit see the author's *American Railroad Economics*, p. 151.

(3) By the "locomotive ton-mile basis" is meant the weight of the locomotive, exclusive of the tender, multiplied by the miles run.

(4) Western passenger fares case decided Dec. 7, 1915.

In the hearings before the commission, the testimony of a number of operating and accounting officials of long experience supported the locomotive-ton-mile basis as the most logical and practical method for apportioning expenses common to freight and passenger service.

This unit was used in the Oklahoma scheme and has been designated by a committee of the Association of American Railway Accounting Officers as capable of producing more nearly correct results than any other basis suggested. It is claimed that the use of the locomotive-ton-mile unit gives full consideration to the greater destructive force caused by the clutching action of the driving wheels. Various estimates have been made of this factor of wear and tear, but no data are available for the establishment of a definite ratio; and even if by experimentation a ratio were established, the value of its application to a particular line of railroad is exceedingly doubtful.

Notwithstanding its merits as a statistical unit, the use of the locomotive-ton-mile as a basis for apportioning maintenance costs of tracks used jointly in passenger and freight service has been strongly opposed by many railroad officers and engineers. The committee on corporate, fiscal and general accounts of the American Railway Accounting Officers in a recent report (January 21, 1915) refused to endorse the locomotive-ton-mile unit on the ground that no means were available for ascertaining whether the excess weight of passenger as compared with freight locomotives in relation to loads hauled makes the necessary correction for speed. Until the relationship between train speed and track damage is definitely determined, apportionment of costs based on comparative locomotive weights is a guess in the dark. (1.)

In two recent investigations involving separation of freight and passenger costs, the locomotive ton-mile unit was rejected in favor of another and more practical standard—the gross-train-weight-mile. The gross-train-weight-mile as the most suitable

(1) An objection to the use of actual locomotive ton-miles in the allocation of railroad maintenance charges is the absence of indication of the maximum loads, which determine the design and materially affect the rate of deterioration of railroad structures. Experience has proven that the greatest damage is done by those loads which create stresses near the elastic limits of the material employed, whereas loads within these limits may be repeated many millions of times without any apparent effect.—See *The Allocation of Railroad Operating Costs,* by Paul M. LaBach in *Engineering Record,* May 13, 1916.

gauge of track wear was adopted by William J. Wilgus in an analysis of passenger service costs on the Ulster and Delaware Railroad, and by W. W. Sparrow in an appraisal of the Mississippi River and Bonne Terre Railroad made for the Missouri public service commission (1). This unit, it seems, was first recommended in a little book written by T. M. R. Talcott in 1904. The author, however, considered some modification of the unit necessary in order to allow for difference in the average rate of speed of passenger and of freight trains. He accordingly suggested multiplying the gross ton-miles of each class of trains by the average speed in miles per hours of that class, thereby obtaining a train-weight-hour-mile.

It is strongly contended by Mr. Wilgus that, generally speaking, speed causes no appreciable difference in the relative effect per ton of weight of passenger and freight trains, if in considering the higher speeds of passenger trains equal attention is paid to destructive agencies peculiar to the freight service, such as "drippings and droppings from coal and refrigerator cars, imperfections of equipment and heavier wheel concentration, twisting action of the locomotives at slow speeds, and the interference of slow trains with track labor, the fouling and destructive action of the products of combustion of inferior grades of coal often used in freight services and the more frequent stoppages and reversals of movements."

Mr. Wilgus admits that, considering the locomotive alone, more damage is done per ton of locomotive weight than per ton of loaded car weight, but this effect is frequently offset by the greater wear caused by the smaller car wheel diameter, less perfect construction and higher up-keep of cars, and the car drippings and droppings. He concludes, therefore, that "under average conditions, a gross ton of passenger train creates the same destructive effect on track and bridges as a gross ton weight of freight train; and that an attempt to assign constructive tonnage to portions of the rolling load as a measure of their assumed excess wear and tear of track and structures will result either in complications and contradictions or in so many variations in the formula as to make the exceptions the rule."

(1) These reports have not been published.

W. W. Sparrow, in his report of the valuation of the Mississippi and Bonne Terre Railroad, used the gross ton-mile basis of apportionment with less assurance of its exactitude for the desired purpose than Mr. Wilgus. "In the absence of any exact and scientific basis for determining the relative amount of injury done the track by freight and passenger service," he states "the gross-ton-mile method is more reasonable and equitable in arriving at what in the final analysis cannot be regarded as anything but an approximation."

The selection by two experienced railroad engineers of the gross train weight mile as the best available unit of apportioning track maintenance cost as between freight and passenger service might be expected to have resulted from a long investigation and general acceptance of this standard. This does not seem to be the case, however. In 1913 a committee of the American Railway Engineering Association had recommended an "equivalent ton-mile," computed from the following formula:

Double the freight locomotive mileage times average weight per locomotive.

Four times the passenger locomotive mileage times the average weight.

Total freight ton-miles (cars and contents).

Double the passenger ton miles (cars and contents).

This formula in effect denotes that the passenger train causes double the damage of the freight train, and that one ton of locomotive weight affects the track as much as two tons of the train weight back of the locomotive. There was vigorous opposition to these views, some engineers pointing out that although passenger traffic as a rule required more expensive roadbed and better upkeep, the freight trains were relatively as destructive of track, if not more so of the track structure. The whole matter was therefore referred to the committee for further study and no subsequent report has yet been made.

In controversies involving separate consideration of passenger and freight rates, the assignment of the operating expenses to the two classes of service is only one side of the problem. The proper division of property value is of equal if not greater importance. Here, the task does not readily admit of scientific analysis. Valuation, at best, is merely a series of approximations. It is

more a matter of judgment than of mathematical formulas (1). Hence, to endeavor to obtain an approximation on the basis of other approximations merely widens the margin of possible errors and may lead to ridiculous results. Both the supreme court and the interstate commerce commission have discountenanced the division of property investment on an arbitrary basis. In the Minnesota rate decision, Justice Hughes denied the contention that gross earnings or net revenue could be made "the basis of the apportionment."

> If the property is to be divided according to the value of the use, it is plain that the gross earnings method is not an accurate measure of value. The value of the use, as measured by the return cannot be made the criterion when the return is itself in question.

In the western passenger case, several railroads submitted to the interstate commerce commission as a basis of apportionment the same ratio of the book cost of the property as had been arbitrarily assigned to costs common to each service. The commission not only rejected the use of the book cost as indicating property value, but also branded as unsatisfactory the "arbitrary method of assigning of this or that portion of the book cost of the entire property to the passenger service." (2)

Since Justice Hughes in the Minnesota rate case suggested that the basis of apportionment of property investment is "to be found in the use that is made of the property," recent investigations have been directed toward the creation of a yard-stick for measuring the comparative extent of use in respect to property devoted to the joint passenger and freight service. Mr. Wilgus in preparing the case of the Ulster and Delaware Railroad in its petition to the New York public service commission for higher passenger fares, apportioned the value of property in joint use on the same ratio basis as was applied in apportioning the expenses of maintenance of such property. Thus the gross train weight miles, i. e., the gross train tonnage unit, was used. This

(1) "The ascertainment of that value is not controlled by artificial rules. It is not a matter of formulas, but there must be a reasonable judgment, having its basis in a proper consideration of all relevant facts."—Minnesota rate cases, 230 U. S. 434.

(2) 37 I. C. C. Several years ago the Pennsylvania Railroad made a rough estimate of property investment allotted separately to passenger and freight service. The formula used was based on expenditures for replacements during a period of 20 years, it being assumed that the entire replacement of the property was covered in a period of twenty years.—Five per cent. case, p. 4156-7.

resulted in 61.2% of the property in joint use being apportioned to freight business and 38.8% to the passenger business. (1.)

Mr. Sparrow, in the valuation of the Mississippi and Bonne Terre Railroad, avoided the application of a single arbitrary unit as a measure of the comparative use of property devoted to joint service. In order to obtain accurate information on which to base estimates, he made tests of actual use of the property during the month of September, 1914. As a result of these tests, he applied to each item of railroad property in joint service a separate yard-stick which in his judgment was best adapted for gauging relative use. The basis of apportionment of roadway items and the freight and passenger percentages are shown in the following table:

BASIS OF APPORTIONMENT OF MAIN-LINE ROAD ITEMS AND FREIGHT AND PASSENGER PERCENTAGES

Account	Basis of apportionment	Per cent. of total	
		Freight	Passenger
Engineering	Average of value of allocations, accounts 3 to 46 inclusive	77.5	22.5
Grading; bridges, trestles and culverts; ties; rails; other track material; ballast; track laying and surfacing; roadway buildings; roadway machines; roadway small tools.	Locomotive ton-miles	76.5	23.5
Land for transportation purposes; tunnels and subways, right-of-way fences; crossings and signs; signals and interlockers	Revenue train miles	45	55
Station and office buildings	Detailed estimate made separating such space in exclusive use of freight or passenger service. Space in joint service apportioned on basis of revenue train-mile	..	..
Water stations	Cost of water supplied to each class of service	78	22
Fuel stations	Cost of fuel supplied to each class of service Apportionment between freight and passenger is made for whole system and then further apportioned between main and branch lines on locomotive-mile basis.	78	22

(1) The New York public service commission of the second district did not pass on the merits of Mr. Wilgus' method, having refused the petition of the railroad for increased passenger rates on the ground that it had no power to grant a rate higher than the maximum permitted by legislative authority.

BASIS OF APPORTIONMENT OF MAIN-LINE ROAD ITEMS AND FREIGHT AND PASSENGER PERCENTAGES—*Continued*

Account	Basis of apportionment	Per cent. of total Freight	Passenger
Shops and engine houses	Cost of service rendered	66	34
Engine house and miscellaneous buildings, Herculaneum			
Buildings under this account located at Bonne Terre	Apportionment between freight and passenger made for whole system as shown below, and then further apportioned between main and branch lines.	..	..
Machine and boiler shop	Cost of locomotive repairs	80	20
Engine house	Cost of service rendered	90	10
Flue rack and flue-cleaning sheds; oil houses; sand dry-house; sand trestle; cinder pit.	Locomotive-miles	70	30
Woodworking shop	Cost of repairs to freight and passenger cars	90	10
Blacksmith's shop; coal house; master mechanic's office and vault	Cost of repairs to all equipment	88	12
Paint shop	Used exclusively in passenger service	..	100
Store house; yard toilet house; hose house; scrap platform; sewerage and drainage; water-supply system.	Average of value of above allocations	73.5	26.5
Power-plant buildings	Apportioned on basis of power supplied and amounts allocated to freight and passenger service of shops to which power is supplied		
Boiler and pump room		80	20
Transformer house		88	12
Power distribution system	Same basis as power-plant buildings	88	12
Shop machinery			
Property under this account located at Riverside, Herculaneum, Flat River, Rivermines and Elvins	Cost of locomotive repairs	80	20
Property under this account located at Bonne Terre in common to whole system.	Apportionment between freight and passenger made for whole system as shown below, and then further apportioned between main and branch lines		
Engine house	Cost of service performed	90	10
Machine shop; boiler shop	Cost of locomotive repairs	80	20
Flue cleaning shed	Locomotive miles	76.5	23.5
Woodworking shop	Cost of repairs to freight and passenger cars	90	10
Blacksmith's shop; master mechanic's office	Cost of repairs to all equipment	88	12
Paint shop	Used exclusively for passenger	..	100
Miscellaneous tools and equipment in Bonne Terre yards	Average of values of above allocations	82.5	17.5
Power-plant machinery	Apportioned on basis of power supplied and amounts allocated to freight and passenger service of shops to which power is supplied	80	20
Power substation apparatus	Same basis as power-plant machinery	88	12

The foregoing table indicates that wherever possible actual conditions were made the basis of determining the apportionment and that arbitraries or units were resorted to only when there was no physical evidence of proportionate use. Moreover, Mr. Sparrow did not limit himself to a universal yard-stick. He used loco-

motive-ton-miles as a basis for estimating the proportionate use of road-bed, bridges, trestles and track superstructures, whereas revenue train-miles were applied in apportioning the value of right of way, tunnels, fences, signals, interlockers, etc. On the other hand, the simple locomotive-mile was the basis of apportionment of value of flue-rack and flue cleaning sheds, oil houses, sand trestles and cinder pits. It is also the unit of apportionment of fuel and machine shop costs as between main line and branches. The division of repair shop investment is on the basis of the comparative repair costs on freight and passenger equipment, and the power plant is apportioned on the basis of power supplied to freight and passenger service.

The work equipment has been apportioned between freight and passenger service on the basis of locomotive-ton-miles, as it is believed that the relative volume of traffic thus reflects the use made of this class of equipment. The percentage to freight service is 80, and to passenger service 20. The results thus obtained were then apportioned between main and branch lines on the relative percentages that the locomotive ton-miles for each class of service for each system are to the total.

Mr. Sparrow's report contains no defense of his methods of apportionment. They are the result of his own personal judgment or the judgment of others concerned in the investigation. The task was an exceedingly difficult one, notwithstanding that the railroad under valuation comprised only thirty miles of main line and twenty-four miles of branches.

The systematic efforts thus far made artificially to separate by formulas property values and operating expenses as between freight and passenger business do not seem to have added anything toward the equitable adjustment of rate controversies. The problems resemble a complicated system of wheels within wheels. Even the most ardent of cost accounting advocates must admit that no formula or device, however well considered, can be uniformly and equitably applied to all railroads or to the same railroad under all conditions of traffic. This is aside from the fact that cost-of-service as a gauge of reasonableness of specific rates "cannot be accurately established by mere theoretical refinements regarding the separation of property values and operating costs."

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